

Routed Sign Specifications



PURPOSE AND SCOPE

The purpose of these specifications is to establish and maintain consistency in the design, construction and installation of routed signs within Maryland State Parks.

These specifications apply to the following types of signs:

- Signs identifying significant features, such as buildings, pavilions, campgrounds, cabins, playgrounds, trailheads, beach areas, and parking areas.
- Signs along “signature” trails, high-use destination trails, historic trails, or other trails for which composite posts are not preferred.

These specifications do not apply to the following types of signs:

- Signs that need to meet ADA-accessibility standards, such as restroom signs or handicapped parking signs.
- Text-heavy signs, such as interpretive signs.
- Regulatory signs, such as “No Hunting” signs or “Alcohol Prohibited” signs.
- Traffic control signs, such as stop signs or speed limit signs.
- Signs along state highways and county roads (unless within the park perimeter).
- Signs for certain trails or trail systems in which composite posts are preferred, such as those with complex intersections, extensive signage, or significant maintenance concerns. (See [Trail Signage and Wayfinding Standards](#) for additional guidance on composite posts).

Questions about these specifications should be directed to the Maryland Park Service Planning Team.

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SIGN PLANNING

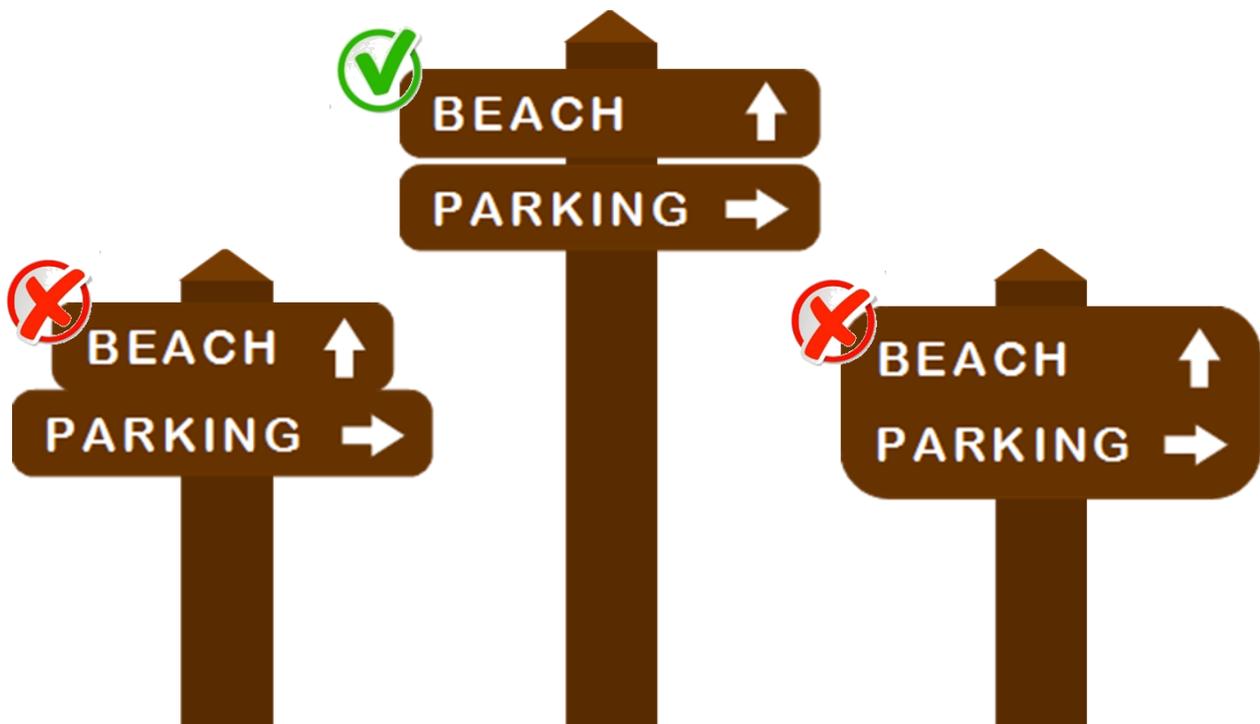
Before making any sign, it is important to assess the site to determine if and where a sign is needed. Minimizing sign pollution and maintaining natural, cultural and historic landscapes should always be a priority.

TO MINIMIZE SIGN POLLUTION:

- Eliminate unnecessary signs and/or sign posts.
- Create distance between signs whenever possible, especially at or near the park entrance and other scenic areas.
- Use the smallest sign necessary to be effective.
- Try to avoid mounting more than three signs on the same post(s).
- Do not mix wood-routed signs with metal or plastic signs on the same post(s).

WHEN PLANNING SIGN LAYOUTS:

- Simplify and reduce wording whenever possible, especially along roadways.
 - For example, if all of the pavilions are in one direction, it may be sufficient to use the general term, "PAVILIONS", with an arrow, rather than displaying the proper names of all pavilions in that direction.
- Avoid listing multiple locations and features on a single sign board.
- Make all signs the same size if they will be mounted on the same post(s).
 - See examples below.
- Create a visible separation between signs mounted on the same post(s).
 - See examples below.
- Contact Mary Owens for further guidance on sign planning and layouts.



SIGN FONTS

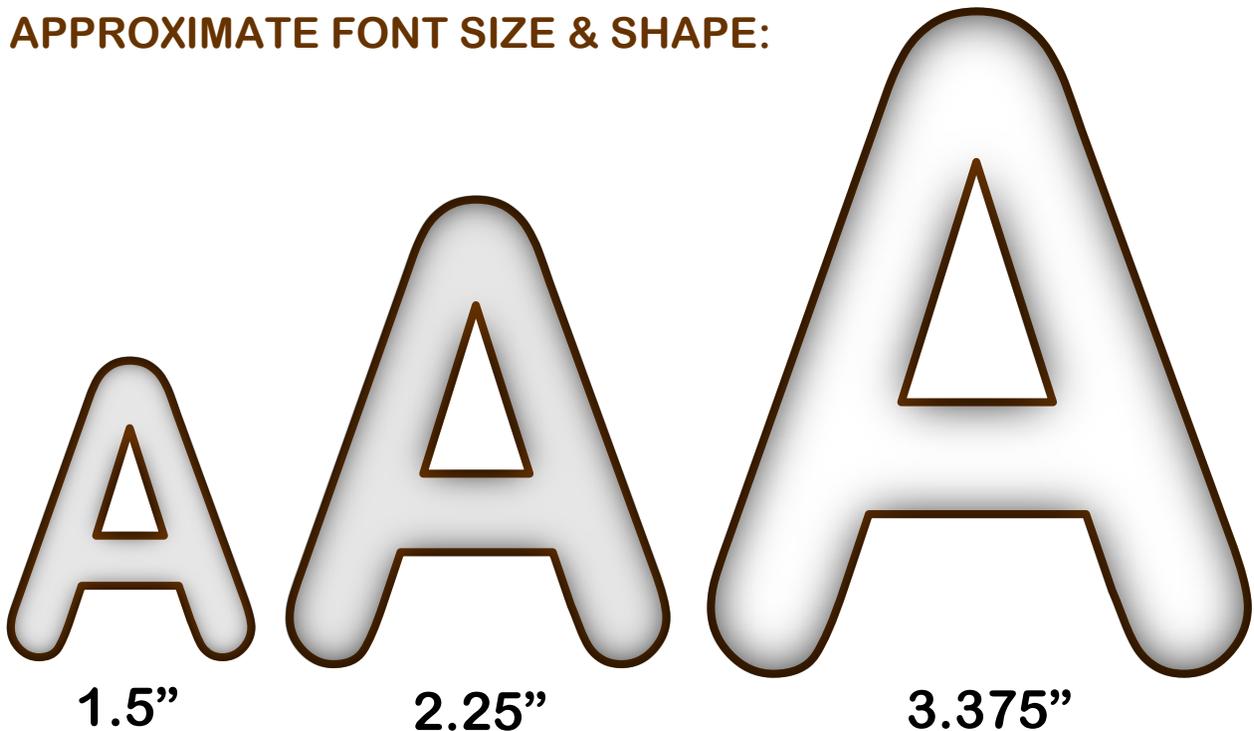
WHEN SELECTING A SIGN FONT:

- Use only approved sign fonts and sizes, as shown in the chart below.*
 - To purchase *Rockler State Park Font* templates, visit www.rockler.com or call 1-800-376-7856.
- Use only UPPERCASE letters.

SIGN FONT			
FOR HAND ROUTING		FOR CNC MACHINE ROUTING	
Rockler's State Park Font (ALL CAPS)		Arial Rounded MT Bold (ALL CAPS)	
FONT SIZE	SMALL 1.5" (1-1/2")	MEDIUM 2.25" (2-1/4")	LARGE 3.375" (3-3/8")
EXAMPLE	Trail Intersection	Interior Camping Loop	Campground Entrance
MAXIMUM VEHICLE SPEED	Foot Traffic	25 mph	35 mph

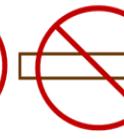
*Maiandra GD is also an approved font, but should only be used for main entrance signs and area signs. For area signs, Maiandra GD should only be used for the area name (i.e. Avalon Area, Hammerman Beach, etc.). All entrance signs and area signs must be reviewed by the Project Review Team prior to purchase or production.

APPROXIMATE FONT SIZE & SHAPE:

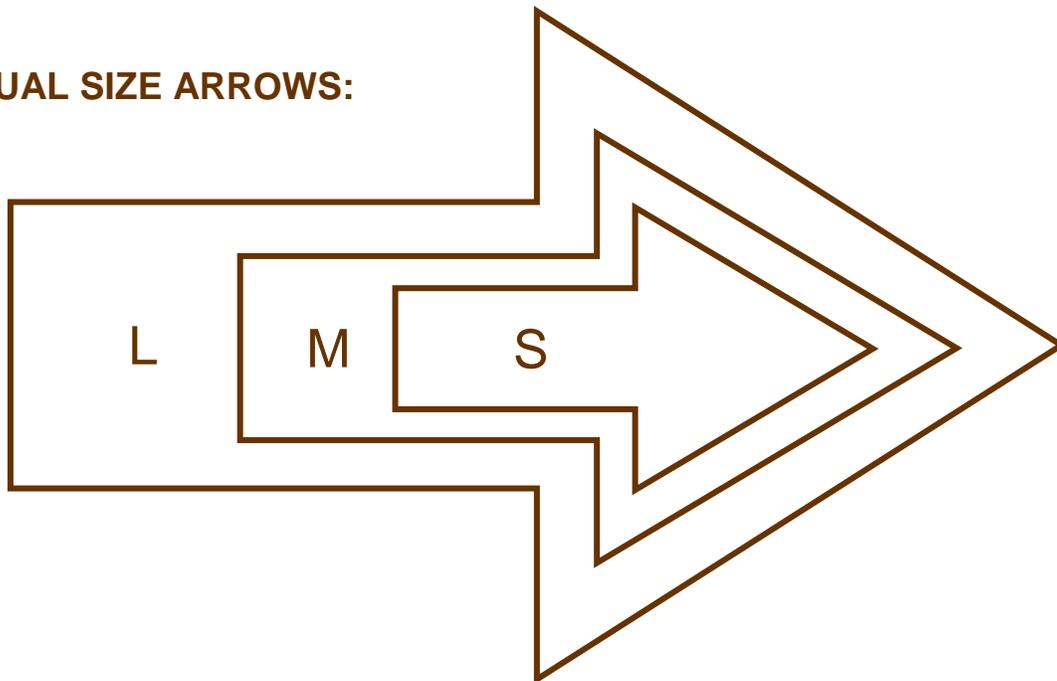


ARROW DESIGN

- If a sign includes a directional arrow, the size and shape of the arrow should be consistent with the standards in the chart below.
- The size of the arrow is determined by the font size (small, medium or large).

ARROW SHAPE			
PROPER	IMPROPER		
			
			
ARROW SIZES			
FONT SIZE	SMALL 1.5"	MEDIUM 2.25"	LARGE 3.375"
ARROW SIZE	1.5" W x 2.5" L	2.25" W x 3.75" L	3.5"W x 5.5"L

ACTUAL SIZE ARROWS:



TO CREATE AN ARROW TEMPLATE FOR HAND-ROUTING:

1. Use scissors to neatly cut out the appropriate arrow from above (small, medium or large, based on font size).
2. Trace the paper arrow onto a sheet of plastic with a thickness of 3/32".
3. Use a utility knife or X-Acto knife to neatly cut out the arrow shape to create a plastic template.
4. Arrows will have rounded edges when routed.

SIGN MATERIAL

WHEN SELECTING SIGN MATERIAL:

- Do NOT use pressure-treated lumber or MDF (medium-density fiberboard), as there may be health concerns associated with the ultra-fine dust created by routing.
- **Make sure the lumber is Forest Stewardship Council (FSC) certified or otherwise sustainably-sourced.**
 - Look for the Forest Stewardship Council (FSC) logo or ask your lumber supplier for sustainably-sourced options.
- Consider using salvaged lumber from local parks or forests if available.
 - Freshly milled lumber must be kiln dried or air dried to a moisture content of 15% or less.
- Choose a board (or section) that is free of knots and visible defects that could interfere with routing.
- Make sure the actual size of the board is large enough to accommodate the sign layout, including text, arrows and margins.
- Keep in mind that actual lumber size will be less than nominal size (see below).



RECOMMENDED LUMBER*			
DOUGLAS FIR (FSC CERTIFIED)			
FONT SIZE	SMALL 1.5"	MEDIUM 2.25"	LARGE 3.375"
ONE LINE OF TEXT	1x4 or 2x6	2x6 or 2x8	2x8 or 2x10
TWO LINES OF TEXT	2x6 or 2x8	2x10 or 2x12	2x12 or (2) 2x8
NOMINAL SIZE		ACTUAL SIZE	
		1.5" x 3.5" (1-1/2" x 3-1/2")	
		1.5" x 5.5" (1-1/2" x 5-1/2")	
		1.5" x 7.25" (1-1/2" x 7-1/4")	
		1.5" x 9.25" (1-1/2" x 9-1/4")	
		1.5" x 11.25" (1-1/2" x 11-1/4")	

*Douglas fir is recommended because it is naturally rot-resistant, easy to rout, and takes paint better than cedar. See the following page for alternative wood varieties and characteristics.

SIGN MATERIAL (CONTINUED)

WOOD VARIETIES AND CHARACTERISTICS		
SPECIES	PROS	CONS
FIR (DOUGLAS)	<ul style="list-style-type: none"> • Rated <i>moderately resistant</i> to decay • Straight-grained • Easy to rout • Takes paint well • Hard for a softwood • Less expensive than cedar 	<ul style="list-style-type: none"> • Special order typically required for 1.5" thickness
CEDAR	<ul style="list-style-type: none"> • Rated <i>resistant or very resistant</i> to decay • Straight-grained • Easy to rout • Lightweight • May be salvage-sourced 	<ul style="list-style-type: none"> • Expensive to purchase • Special order required for 1.5" thickness • Usually has knots • Does not take paint well (requires a primer)
PINE	<ul style="list-style-type: none"> • Straight-grained • Easy to rout • Takes paint well • Inexpensive 	<ul style="list-style-type: none"> • Rated <i>slightly resistant or non-resistant</i> to decay
POPLAR	<ul style="list-style-type: none"> • Inexpensive • Straight-grained • Very few knots • Easy to rout • Takes paint well 	<ul style="list-style-type: none"> • Rated <i>slightly resistant or non-resistant</i> to decay • Soft for a hardwood • Tends to leave fuzzy surfaces and edges (requires sharp bits and low router speed)
OAK	<ul style="list-style-type: none"> • Rated <i>resistant or very resistant</i> to decay • Straight-grained • Takes paint well 	<ul style="list-style-type: none"> • Heavy • Expensive to purchase • Tends to splinter when routed • Moderate blunting effect on router bits
ASH	<ul style="list-style-type: none"> • Straight-grained • Takes paint well • Lightweight • Readily available if salvage-sourced 	<ul style="list-style-type: none"> • Moderate blunting effect on router bits • Tends to splinter • Rated <i>slightly resistant or non-resistant</i> to decay

Source: wood-database.com

ROUTERS

FOR CNC MACHINE ROUTING:

- Make sure the router is fully compatible with the CNC machine.
 - The following routers are compatible with the CNC Shark HD4:
 - Bosch 1617 and 1618
 - Porter Cable 890 Series
 - Porter Cable 690 Series
 - DeWalt 610, 616, 618

FOR HAND ROUTING WITH TEMPLATES:

- Make sure the router has a plunge base.
 - This prevents damage to the template by allowing the router to rest on the surface while the bit is lowered or “plunged” into the cut.
- Make sure the router has a 1/4” collet.
 - This means it will accept bits with 1/4” shanks.
- Make sure the router will accept a standard guide bushing.
 - This is needed to keep the router bit inside the walls of the template.
 - Brass bushings are included with Rockler State Park Font kits.



**DeWalt DWP611PK
Router with Plunge Base**



**Plunge Base with
Brass Bushing**



ROUTER BITS

WHEN SELECTING A ROUTER BIT:

- Make sure the bit is the correct size for the selected font (see below).
- Make sure the bit is carbide-tipped.
 - These last longer and maintain a sharper cutting edge than steel.
- Make sure the bit is plunge-cutting.
 - These have a bottom cutter which allows the bit to bore a hole as it is plunged into the work.
- Make sure the bit shank is compatible with the router collet.
 - Some routers will accept bits with 1/4" or 1/2" shanks, while others will only accept 1/4" shanks.

ROUTER BITS		
1.5" Font	2.25" Font	3.375" Font
		
3/16" D x 5/16" H 1/4" Shank Rockler #52950 (\$18)	3/8" D* x 3/8" H 1/4" Shank Rockler #36676 (\$20)	5/8" D x 1/2" H 1/4" Shank Rockler #32443 (\$22)

*For CNC machine routing, use a 1/4" diameter bit (instead of 3/8") for the 2-1/4" font size.

GUIDE BUSHINGS (INCLUDED WITH TEMPLATE KITS)		
1.5" Font	2.25" Font	3.375" Font
3/16" ID, 5/16" OD Rockler #57773 (\$8)	3/8" ID, 1/2" OD Rockler #33967 (\$8)	5/8" ID, 3/4" OD Rockler #30933 (\$8)

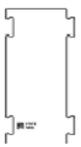
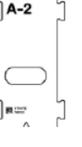
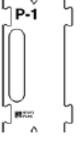
SIGN LAYOUT

When creating sign layouts, it is sometimes necessary to adjust the kerning (spacing) between certain letter combinations to avoid awkward spacing.

FOR HAND-ROUTING:

- Use *Rockler's* Sign Making Wizard to create a custom routing plan with proper spacing*: signmaking.rockler.com
- Print your custom routing plan, which will detail the template layouts needed to complete your sign with proper spacing.
- Note that it may take more than one pass with the router to complete certain letters and letter combinations.

*Spacing can also be determined manually by using the kerning charts in Appendix A.

										
	S	T	A	T	E		P	A	R	K
1st Pass										
2nd Pass										
3rd Pass										
4th Pass										



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SIGN LAYOUT (CONTINUED)

WHEN POSITIONING TEXT ON THE SIGN:

- Make sure the text is square with the top and bottom edges of the sign.
- Use the chart below to determine appropriate margins.
 - The top and bottom margins should always be equal.
 - The side margins should always be equal to the top and bottom margin x 1.5.
- See Appendix B for sample layouts.

MARGINS			
FONT SIZE	SMALL 1.5"	MEDIUM 2.25"	LARGE 3.375"
TOP/ BOTTOM MARGINS	1" – 2"	1.5" – 2.5"	2" – 3"
SIDE MARGINS	SIDE MARGIN = TOP/ BOTTOM MARGIN X 1.5		
SPACE BETWEEN TWO LINES OF TEXT	1" – 1.5"	1" – 1.5"	1.5 - 2"

EXAMPLES:

FONT = 3.375" (3-3/8")	A = 1.5" (1-1/2")	B = 2.25" (2-1/4")
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FONT = 2.25" (2-1/4")	A = 1.5" (1-1/2")	B = 2.25" (2-1/4")
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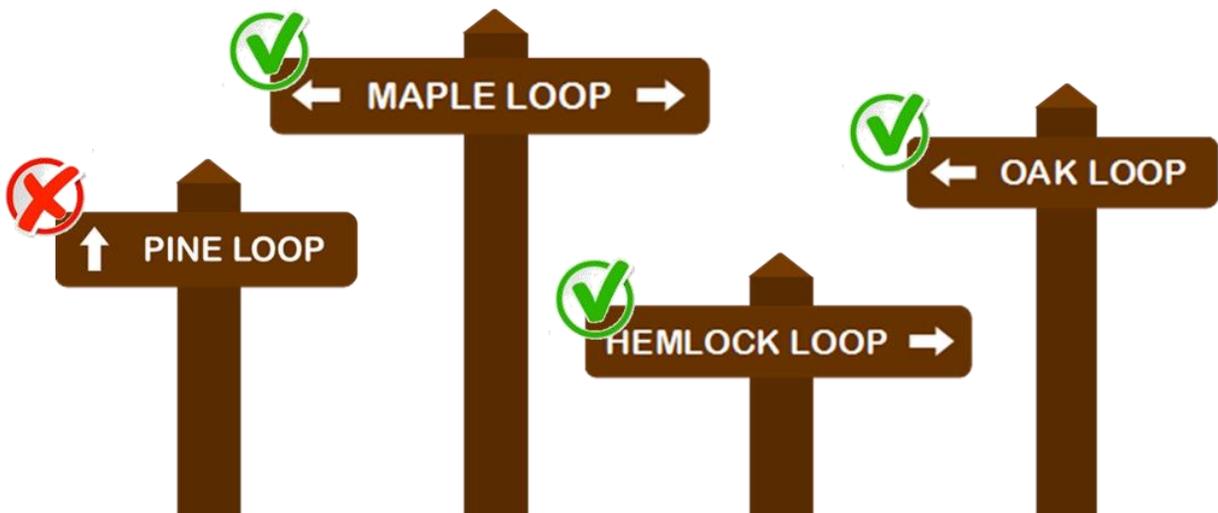


SIGN LAYOUT (CONTINUED)

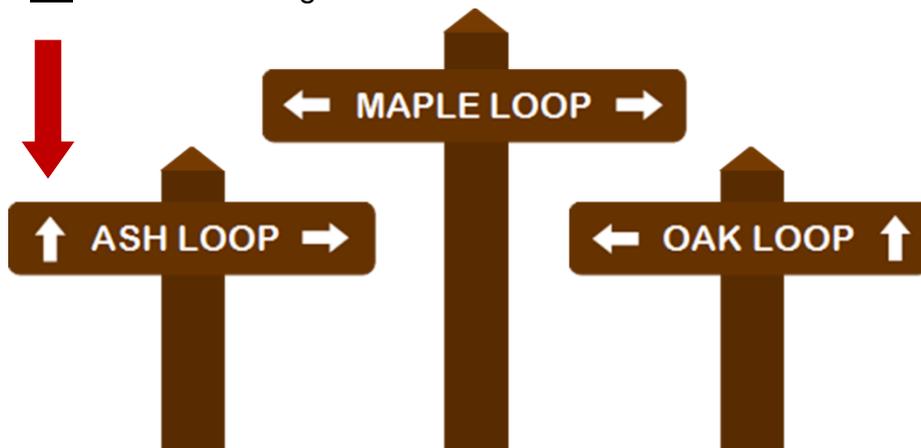
WHEN POSITIONING ARROWS ON THE SIGN:

- Use the chart below to determine proper arrow placement.
- Note that the direction of an arrow will determine its position on the sign.

ARROW PLACEMENT				
LEFT OF TEXT	LEFT OF TEXT	RIGHT OF TEXT	RIGHT OF TEXT	RIGHT OF TEXT
				



- When two arrows are needed, the text should be centered between the arrows as shown below.
 - Note that this may require placing the “straight ahead arrow on the left instead of the right.



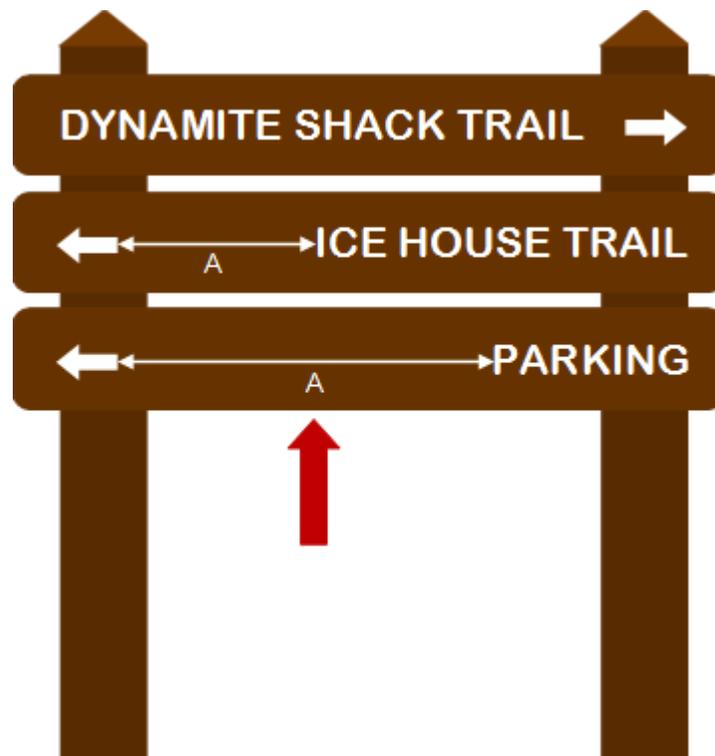
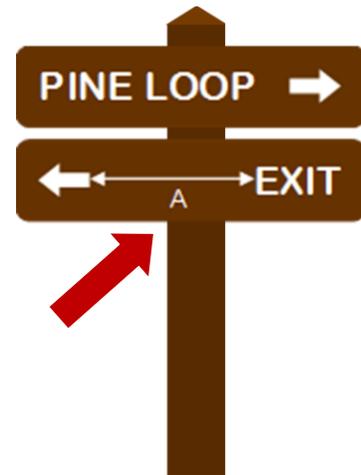
SIGN LAYOUT (CONTINUED)

WHEN POSITIONING ARROWS ON THE SIGN:

- Use the chart below to determine proper spacing between the arrow and text.

ARROW PLACEMENT			
FONT SIZE	SMALL 1.5"	MEDIUM 2.25"	LARGE 3.375"
SPACE BETWEEN ARROW AND TEXT	$\geq 1.5''$ (1-1/2")	$\geq 2.25''$ (2-1/4")	$\geq 3.375''$ (3-3/8")

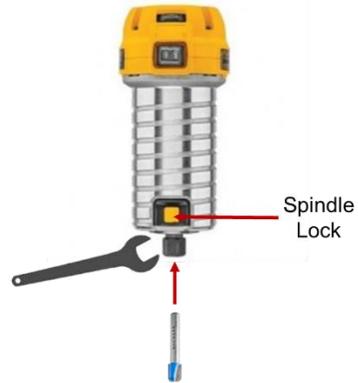
- Note that the space between the arrow and text may be greater than the minimum specified if multiple signs are grouped together.
- "A" is determined by the amount of space needed to make all of the signs the same size, with equal margins.



HANDHELD ROUTER SETUP AND OPERATION

TO SETUP A HANDHELD ROUTER:

1. Make sure the router is unplugged. Insert the router bit and tighten into place.



2. Attach the guide bushing to the plunge base.



3. Place the router into its plunge base.



4. Adjust the depth gauge to desired cutting depth (up to 1/4").



HANDHELD ROUTER SETUP AND OPERATION

TO OPERATE A HANDHELD ROUTER:

1. Use double-sided tape or painters tape to secure the templates to the sign. Use clamps to keep the sign in place while routing.



2. Put on personal protective equipment, including eye protection, hearing protection, and a respiratory mask.



3. Place the router on the sign and allow the guide bushing to rest within the first letter template.



4. Turn the router on, press the release lever on the router, and plunge the bit into the cutout.



5. Slowly guide the router along the cutout. Press the release lever down to allow the bit to retract between each letter.

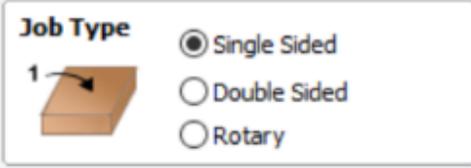
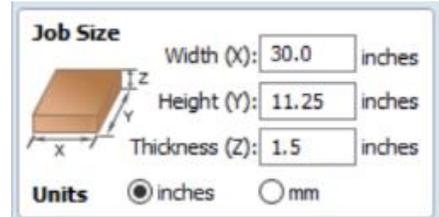
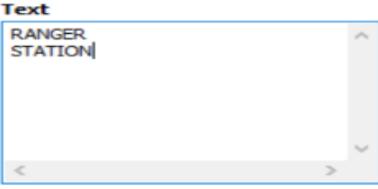
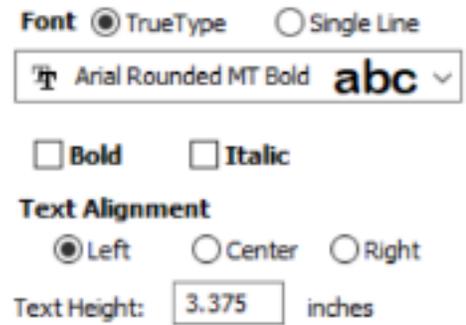


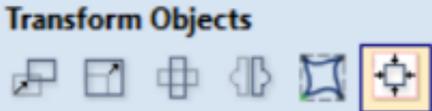
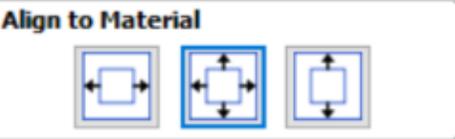
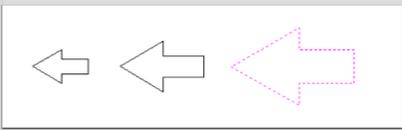
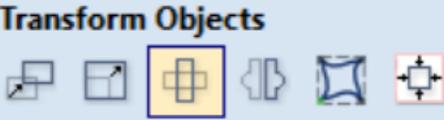
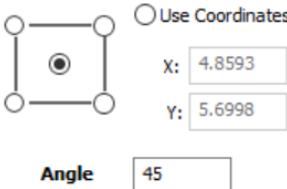
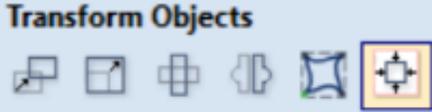
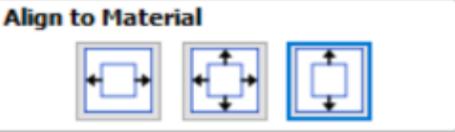
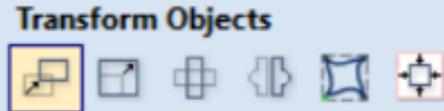
IMPORTANT! DO NOT LIFT THE ROUTER OFF THE TEMPLATE WHILE THE MOTOR IS RUNNING. (THIS WILL DESTROY THE TEMPLATE).

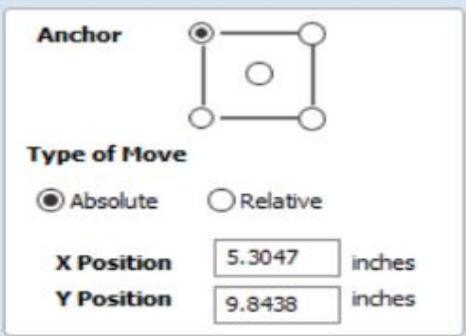
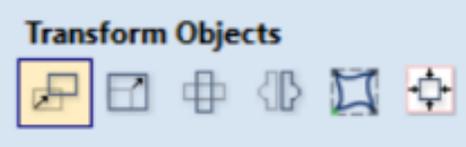
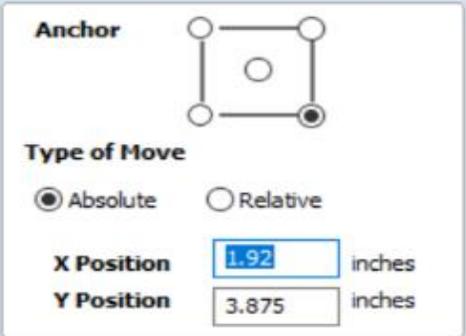
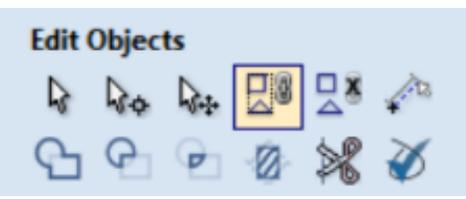
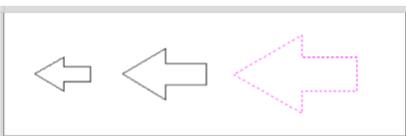
CNC SHARK HD4 SETUP AND OPERATION

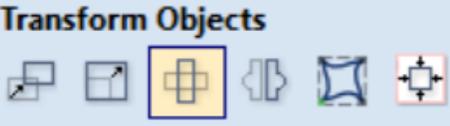
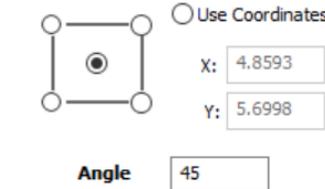
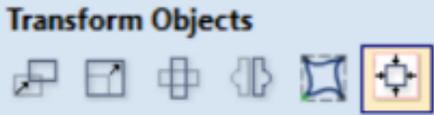
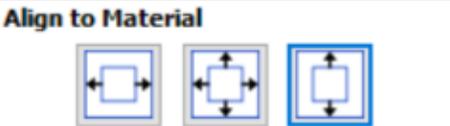
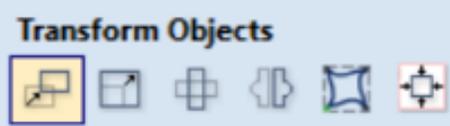
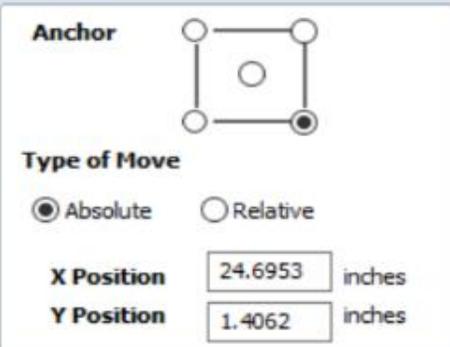
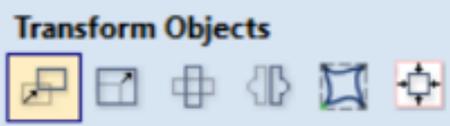
IMPORTANT! THIS CHART IS INTENDED TO PROVIDE GUIDANCE FOR AUTHORIZED CNC OPERATORS ONLY. ALWAYS READ AND FOLLOW ALL SAFETY AND OPERATING INSTRUCTIONS FROM THE MANUFACTURER.

TO CREATE A VCARVE FILE:

<p>1. Open the VCarve program and select <i>Create a New File</i>.</p>	
<p>2. Under <i>Job Type</i>, choose <i>Single Sided</i>. (Choose <i>Double Sided</i> for cantilever post signs only).</p>	
<p>3. Under <i>Job Size</i>, enter the actual board dimensions as described below. (See Page 5 for guidance). Then click <i>OK</i>.</p> <ul style="list-style-type: none"> • <i>Height (Y)</i> = Actual Board Width • <i>Thickness (Z)</i> = Actual Board Thickness • <i>Width (X)</i> = Estimated Sign Length* 	<p>EXAMPLE FOR 2x12 BOARD:</p>  <p>*NOTE: <i>Width (X)</i> can be adjusted later in the design process.</p>
<p>To add text to the design:</p>	
<p>4. Under <i>Create Vectors</i>, use the <i>Draw Text</i> tool to open a text box.</p>	
<p>5. Type the desired text in the text box, using ALL CAPS. If two lines are preferred, hit enter between lines.</p>	
<p>6. Under <i>Font</i>, select <i>Arial Rounded MT Bold</i>. Enter the desired <i>Text Height</i>. Then click <i>Close</i>.</p> <ul style="list-style-type: none"> • Small Font = 1.5 (inches) • Medium Font = 2.25 (inches) • Large Font = 3.375 (inches) 	

To center the text:	
7. Under <i>Transform Objects</i>, click <i>Align Selected Objects</i> to open alignment tools.	
8. Under <i>Align to Material</i>, select the middle option to center the text. Then click <i>Close</i>.	
If there are no arrows in the design, proceed to Step 37.	
To add an arrow on the RIGHT side of the text, proceed to Step 23.	
To add an arrow on the LEFT side of the text:	
9. Open the ARROWS** file and select the proper size arrow. (See Page 4 for guidance).	
10. Copy the arrow, then return to the sign file, and click <i>Paste</i>.	**Contact Greg Risavi or Erin Thomas for access to the ARROWS file.
11. Select the arrow by clicking on the arrow outline, then click <i>Rotate Selected Objects</i>.	
12. Select the midpoint as the <i>Anchor</i>. Enter <u>45</u> (degrees) as the angle. Click <i>Apply</i> until the arrow points to the proper direction. Then click <i>Close</i>. (See Page 11 for guidance).	
13. Under <i>Transform Objects</i>, click <i>Align Selected Objects</i> to open alignment tools.	
14. Under <i>Align to Material</i>, select the third option to center the arrow. Then click <i>Close</i>.	
15. Select the text by clicking on the text outline, then click <i>Move Selected Objects</i>.	

<p>16. Select either left corner as the <i>Anchor</i>. (This is the left edge of the text).</p>									
<p>17. Note the <i>X Position</i> here: _____. Then click <i>Close</i>.</p>	<table border="1"> <thead> <tr> <th>Font Size</th> <th>Minimum Distance Between Arrow and Text</th> </tr> </thead> <tbody> <tr> <td>Small (1.5")</td> <td>1.5"</td> </tr> <tr> <td>Medium (2.25")</td> <td>2.25"</td> </tr> <tr> <td>Large (3.375")</td> <td>3.375"</td> </tr> </tbody> </table>	Font Size	Minimum Distance Between Arrow and Text	Small (1.5")	1.5"	Medium (2.25")	2.25"	Large (3.375")	3.375"
Font Size	Minimum Distance Between Arrow and Text								
Small (1.5")	1.5"								
Medium (2.25")	2.25"								
Large (3.375")	3.375"								
<p>18. Subtract the font size (minimum distance between arrow and text) from the <i>X Position</i> noted above. Note the value here: _____.</p>									
<p>20. Select either right corner as the <i>Anchor</i> (This is the right edge of the arrow).</p>									
<p>21. Enter the value from Step 18 as the <i>X Position</i>. Click <i>Apply</i>, then <i>Close</i>.</p>									
<p>22. "Lock" the spacing between the text and arrow by selecting both objects (hold the <i>shift</i> button while clicking on each outline). Then click <i>Group Selected Objects</i>.</p>	<p style="background-color: red; color: black; text-align: center;">If there are no other arrows in the design, proceed to Step 37.</p>								
<p style="background-color: #d3d3d3; text-align: center;">To add an arrow on the RIGHT side of the text:</p>									
<p>23. Open the ARROWS** file and select the proper size arrow. (See Page 4 for guidance).</p>	 <p>**Contact Greg Risavi or Erin Thomas for access to the ARROWS file.</p>								
<p>24. <i>Copy</i> the arrow, then return to the sign file, and click <i>Paste</i>.</p>									

<p>25. Select the arrow by clicking on the arrow outline, then click <i>Rotate Selected Objects</i>.</p>									
<p>26. Select the midpoint as the <i>Anchor</i>. Enter <u>45</u> (degrees) as the angle. Click <i>Apply</i> until the arrow points to the proper direction. Then click <i>Close</i>. (See Page 11 for guidance).</p>									
<p>27. Under <i>Transform Objects</i>, click <i>Align Selected Objects</i> to open alignment tools.</p>									
<p>28. Under <i>Align to Material</i>, select the third option to center the arrow. Then click <i>Close</i>.</p>									
<p>29. Select the text by clicking on the text outline, then click <i>Move Selected Objects</i>.</p>									
<p>30. Select either right corner as the <i>Anchor</i>. (This is the right edge of the text).</p>									
<p>31. Note the <i>X Position</i> here: _____. Then click <i>Close</i>.</p>									
<p>32. Add the font size (minimum distance between arrow and text) to the <i>X Position</i> noted above. Note the value here: _____.</p>	<table border="1"> <thead> <tr> <th>Font Size</th> <th>Minimum Distance Between Arrow and Text</th> </tr> </thead> <tbody> <tr> <td>Small (1.5")</td> <td>1.5"</td> </tr> <tr> <td>Medium (2.25")</td> <td>2.25"</td> </tr> <tr> <td>Large (3.375")</td> <td>3.375"</td> </tr> </tbody> </table>	Font Size	Minimum Distance Between Arrow and Text	Small (1.5")	1.5"	Medium (2.25")	2.25"	Large (3.375")	3.375"
Font Size	Minimum Distance Between Arrow and Text								
Small (1.5")	1.5"								
Medium (2.25")	2.25"								
Large (3.375")	3.375"								
<p>33. Select the arrow by clicking on the arrow outline, then click <i>Move Selected Objects</i>.</p>									

34. Select either left corner as the *Anchor*. (This is the left edge of the arrow).

Anchor

Type of Move

Absolute Relative

X Position 28.075 inches

Y Position 3.5075 inches

35. Enter the value from Step 32 as the *X Position*. Click *Apply*, then *Close*.

36. “Lock” the spacing between the text and arrow by selecting both objects (hold the *shift* button while clicking on each outline). Then click *Group Selected Objects*.

To make the side margins equal to the top/ bottom margins x 1.5:

37. Select the artwork (text and arrow/s) by clicking on the outline, then click *Move Selected Objects*.

38. Select the bottom-left corner as the *Anchor*. (This is the bottom-left edge of the artwork).

Anchor

Type of Move

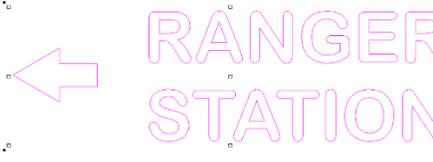
Absolute Relative

X Position 2.1 inches

Y Position 1.4062 inches

39. Multiply the *Y Position* (bottom margin) x 1.5. Note the value here: _____. (This is the side margin).

40. Enter the value from above as the *X Position*, then click *Apply*.



41. Move the *Anchor* to the bottom-right corner. (This is the right edge of the artwork).

Anchor

Type of Move

Absolute Relative

X Position 30.3749 inches

Y Position 1.4062 inches

42. Note the *X Position* of the bottom-right corner here: _____. Then click *Close*.

43. Add the value from Step 39 (side margin) to the *X Position* from Step 42. Note the sum as the total board *Width (X)* here: _____.

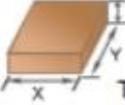
Job Size

Width (X): inches

Height (Y): inches

Thickness (Z): inches

Units inches mm



44. Select *Edit – Job Size and Position*. Under *Job Size*, enter the total board *Width (X)* from above. Then click *OK*.



If the design is complete, proceed to Step 51.

To make the sign longer (to match the length of other signs in a group):

45. Select *Edit – Job Size and Position*. Under *Job Size*, enter the width of the largest sign in the group as the *Width (X)*. Also note that value here: _____. Then click *OK*.

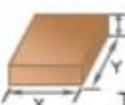
Job Size

Width (X): inches

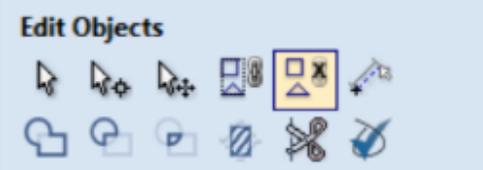
Height (Y): inches

Thickness (Z): inches

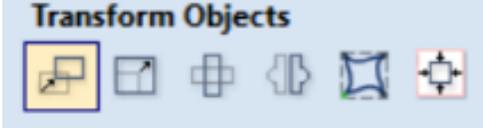
Units inches mm



46. Select the artwork, then click *Ungroup Objects*. (This will allow the text and arrow(s) to be moved as separate objects).



47. Select the object (text or arrow) closest to the right margin, then click *Move Selected Objects*.



48. Select the bottom-right corner as the *Anchor*. (This is the right edge of the object selected).

Anchor



Type of Move

Absolute Relative

X Position inches

Y Position inches

49. Subtract the side margin (Step 39) from the sign width (Step 45). Note the value here: _____.

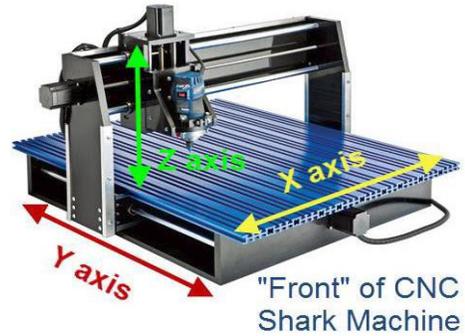
50. Enter the value from above as the *X Position* for the bottom-right *Anchor*. Click *Apply*, then *Close*.



IMPORTANT!

The Shark HD4 with Extended Bed can only machine an area up to $X=20''$, $Y=50''$, $Z=7''$.

If the total *Job Size Width (X)* is greater than $20''$, the design will need to be rotated to fit the machine bed.



To determine if the design will fit the machine bed:

51. Select *Edit - Job Size and Position* to compare the job size with the maximum machine area:

- Maximum Width (X) = $20''$
- Maximum Height (Y) = $50''$
- Maximum Thickness (Z) = $7''$

Job Size

Width (X): inches

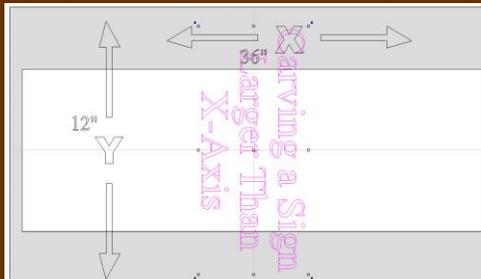
Height (Y): inches

Thickness (Z): inches

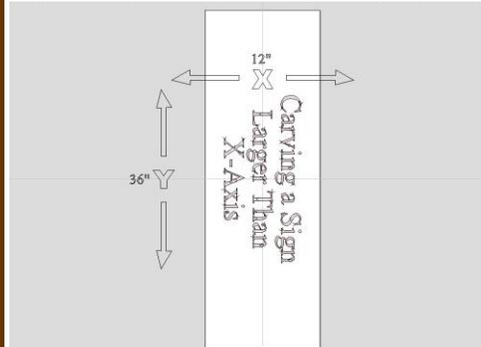
Units inches mm

To rotate the design to fit the machine bed (if $X > 20''$):

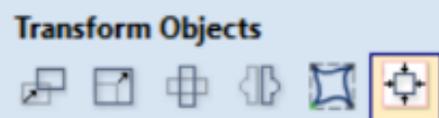
52. Group all text and arrows together (Step 36). Use the *Rotate Selected Objects* tool to rotate the text and arrows by -90 degrees (Step 11). Click *Apply*, then *Close*.

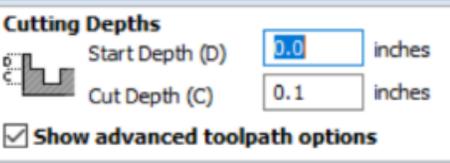
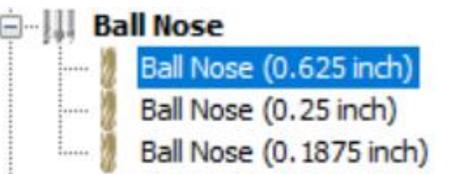
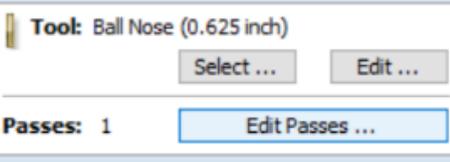
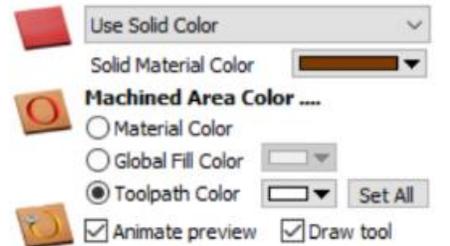
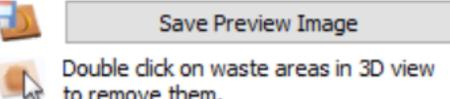


53. Select *Edit - Job Size and Position*. Under *Job Size*, swap the dimensions for *Width (X)* and *Height (Y)* to rotate the board to match the new text orientation. Then click *OK*.



54. If needed, use the *Align Selected Objects* tool to re-center the artwork (Steps 7-8).



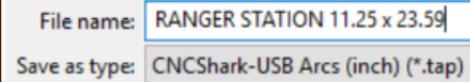
To calculate and preview the toolpath:													
<p>55. After verifying that the design will fit the machine bed, select the <i>Toolpaths</i> tab in the upper right corner.</p>													
<p>56. Under <i>Toolpath Operations</i>, select <i>Pocket Toolpath</i>.</p>													
<p>57. Under <i>Cutting Depths</i>, enter 0.1 (inches) as <i>Cut Depth</i>.</p>													
<p>58. Under <i>Tool</i>, click <i>Select</i>. Then Select the appropriate size <i>Ball Nose</i> router bit from the <i>Tool List</i>. (See Page 8 for bit specifications).</p>	<table border="1"> <thead> <tr> <th>Ball Nose</th> <th>Feed Rate</th> <th>Plunge Rate</th> </tr> </thead> <tbody> <tr> <td>5/8" (0.625")</td> <td>120 in/min</td> <td>60 in/min</td> </tr> <tr> <td>1/4" (0.25")</td> <td>100 in/min</td> <td>30 in/min</td> </tr> <tr> <td>3/16" (0.1875")</td> <td>75 in/min</td> <td>20 in/min</td> </tr> </tbody> </table>	Ball Nose	Feed Rate	Plunge Rate	5/8" (0.625")	120 in/min	60 in/min	1/4" (0.25")	100 in/min	30 in/min	3/16" (0.1875")	75 in/min	20 in/min
Ball Nose	Feed Rate	Plunge Rate											
5/8" (0.625")	120 in/min	60 in/min											
1/4" (0.25")	100 in/min	30 in/min											
3/16" (0.1875")	75 in/min	20 in/min											
<p>59. Under <i>Feeds and Speeds</i>, enter an appropriate <i>Feed Rate</i> and <i>Plunge Rate</i>, based on the size of the bit.</p>													
<p>60. Under <i>Tool</i>, click <i>Edit Passes</i>. Change the <i>Number of Passes</i> to 1 pass.</p>													
<p>61. Select all sign text and arrows, then click <i>Calculate</i>.</p>													
<p>62. Under <i>Preview Toolpath</i>, select <i>Use Solid Color (Brown)</i>. Then select <i>Toolpath Color (White)</i>.</p>													
<p>63. If desired, select <i>Save Preview Image</i> to save it as a JPEG file.</p>													

To transfer the file to the CNC machine:

64. When the file is complete, make sure the Toolpath is selected, then click *Save Toolpath* to save it as a TAP file.



65. Save the TAP file to a USB drive with the sign text and dimensions displayed as the file name.



66. Transfer the USB drive to the touch screen pendant using the USB port on the right side of the pendant.



To prepare the machine:

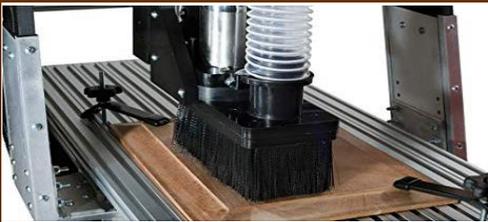
67. With the power off, install the appropriate router bit. (The bit must match the tool selected in Step 58).

Font Size	Router Bit Size
Small	3/16" (0.1875") Ball Nose
Medium	1/4" (0.25") Ball Nose
Large	5/8" (0.625") Ball Nose

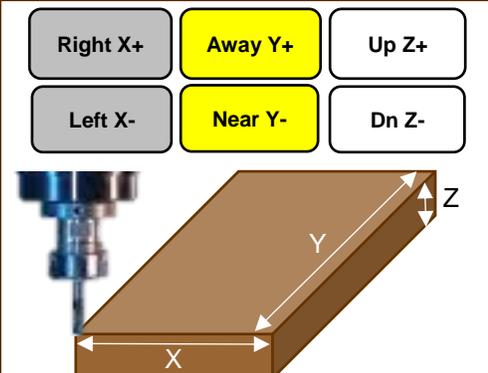
68. With the power off, use clamps to secure the board to the CNC machine bed. Be careful to avoid the toolpath.

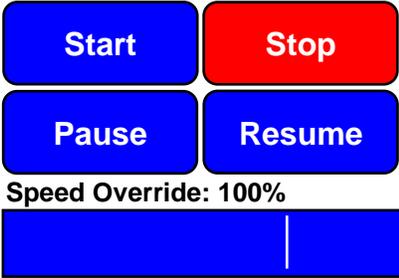


69. Use personal protective equipment, including eye protection, hearing protection, and dust boot/ dust collection system.



70. Turn the power on. Use the *Right/ Left, Away/ Near and Up/ Dn* buttons on the LCD pendant to move the router bit to the very top of the board at the lower left corner.



<p>71. Once the router bit is in position, press the Zero xyz button to reset zero. This will be the starting and stopping place for the router.</p>	
<p>72. Next press the USB button and select the appropriate TAP file.</p>	
<p>73. Verify that the file is correct, then press Next.</p>	
<p>74. Press the Start button to begin routing the sign. Use the Speed Override slide bar to start slow in case there is a problem. Press the Stop button if there is a problem.</p>	

SAFETY REMINDERS:

- Always read and follow all safety and operating instructions from the manufacturer.
- Always wear personal protective equipment, including eye protection, ear protection, and a dust collection system.
- Always use a surge protector to minimize potential damage to the machine.
- Always turn the power off before positioning a work piece, adjusting the position of the tool, changing a bit, or setting up clamps.
- Always position clamps carefully to avoid interference with the cutter and gantry.
- Always make sure the work piece is firmly secured to the table before operating the machine.
- Never attempt to adjust the work piece while the machine is running.
- Never attempt to manually feed a work piece into a running cutter.
- Always allow the machine and spindle to come to a complete stop before touching any part of the machine.
- Never attempt to remove chips, dust or debris while the machine is running.
- Always keep the machine and surrounding area clear of miscellaneous tools and equipment.
- Always keep the machine clean and lubricated.
- Never leave the machine unattended while it is running.

FINISHING TOUCHES

TO FINISH THE SIGN:

- Use the chart below to determine the appropriate radius for the corners.
- Measure the distance of the radius from the top and side edges of the sign, and make a mark where the two lines cross. (See illustration below).
- Use a pivot compass to draw a curve between the two edges of the sign.
- Use a band saw or jig saw to cut along the curve and remove the corner.
- Repeat the process for all four corners.
- Sand all edges and surfaces of the sign with 80-100 grit sandpaper.
- Paint the sign, using only approved colors, as shown in the chart below.
- Add reflective beads to letters and arrows between each coat of paint.

CORNERS					
LUMBER SIZE	2 x 4	2 x 6	2 x 8	2 x 10	2 x 12
CORNER RADIUS	3/4"	1"	1-1/2"	2"	2-1/2"
PAINT					
SIGN BOARDS AND POSTS	Sherwin Williams Soldiers Delight Brown (custom)				
SIGN TEXT AND ARROWS	Sherwin Williams Extra White				



SHERWIN WILLIAMS SOLDIERS DELIGHT BROWN					
Superdeck Solid Color	Colorant	OZ	32	64	128
Waterborne	B1 Black	4	4	1	1
Flat	N1 Raw Umber	2	2	1	1
One Gallon	R2 Maroon	-	49	-	-
Ultradeep	R3 Magenta	2	7	-	-

INSTALLATION

TO PREPARE SIGN POSTS:

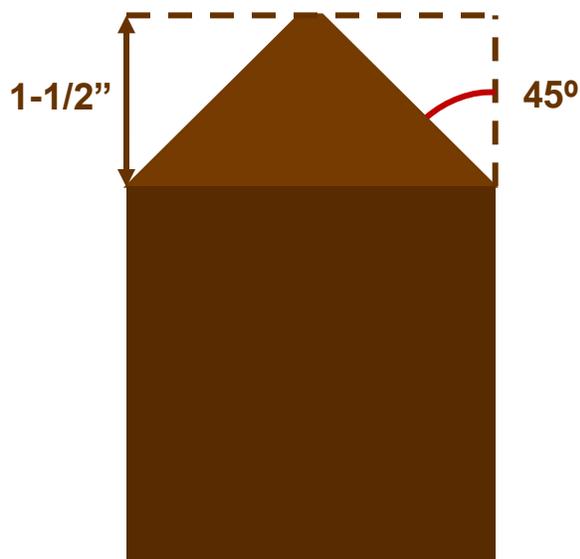
- Use ground contact pressure-treated 4x4 posts.
- Use one post for signs up to 32" long.
- Use two posts for signs more than 32" long.
- Cut the posts to the desired length. (See chart below).
- Bevel-cut the top to shed water. (See instructions below).
- Paint the posts Soldier's Delight Brown.

POST LENGTH	
TOTAL SIGN DIMENSIONS	TOTAL POST LENGTH
2x4, 2x6, 2x8, 2x10	6-7 FEET*
2x10, 2x12, 2x16, 2x20, 2x24	7-8 FEET*
2x24, 2x30, 2x36	8-9 FEET*

*Measurements apply to installation on level ground, with posts planted two feet deep. Post length may need to be adjusted based on terrain, vegetation, sight distance or other factors. See examples on the following pages.

TO BEVEL-CUT THE SIGN POSTS:

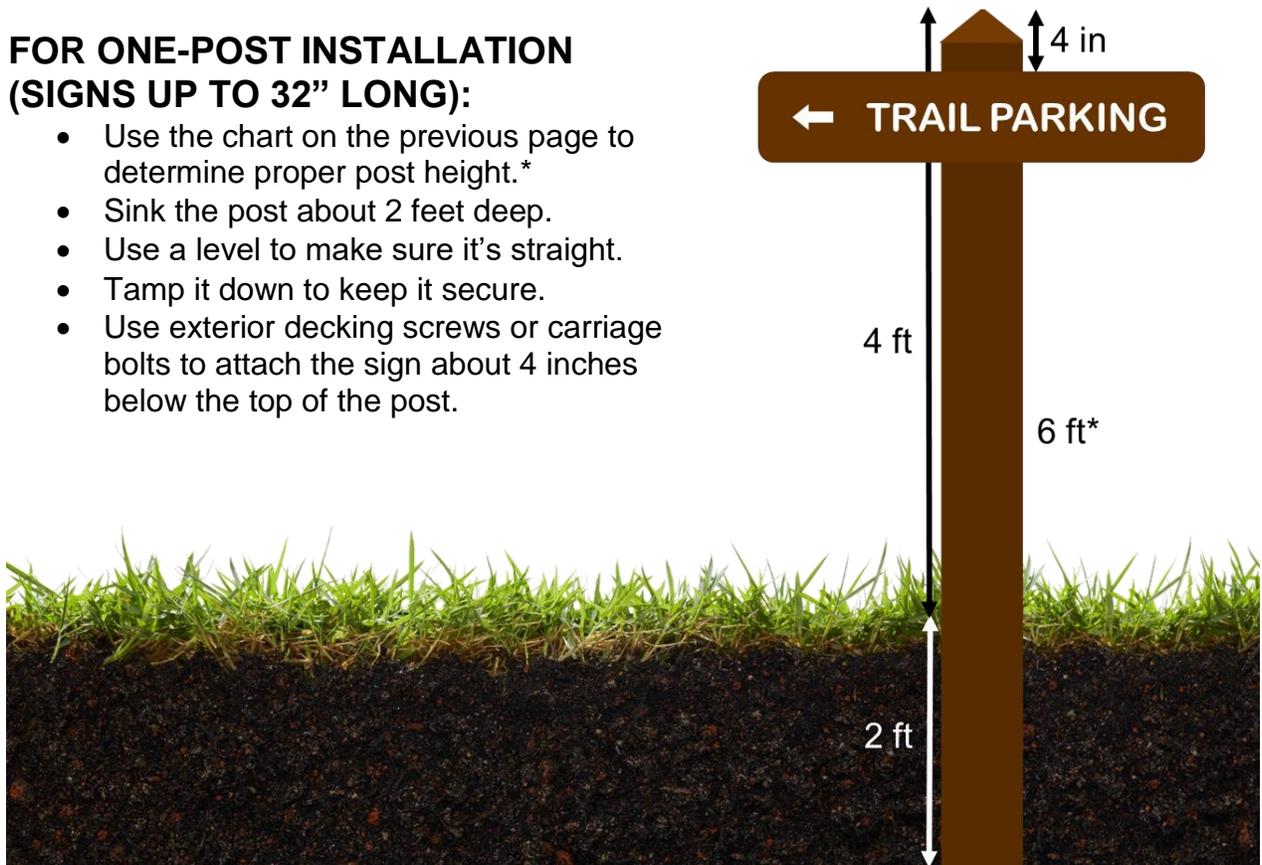
1. Measure 1-1/2" from the top of the post.
2. Set the blade of a radial arm saw at a 45-degree angle and cut the post.
3. Repeat the steps for all four sides of the post.



INSTALLATION (CONTINUED)

FOR ONE-POST INSTALLATION (SIGNS UP TO 32" LONG):

- Use the chart on the previous page to determine proper post height.*
- Sink the post about 2 feet deep.
- Use a level to make sure it's straight.
- Tamp it down to keep it secure.
- Use exterior decking screws or carriage bolts to attach the sign about 4 inches below the top of the post.



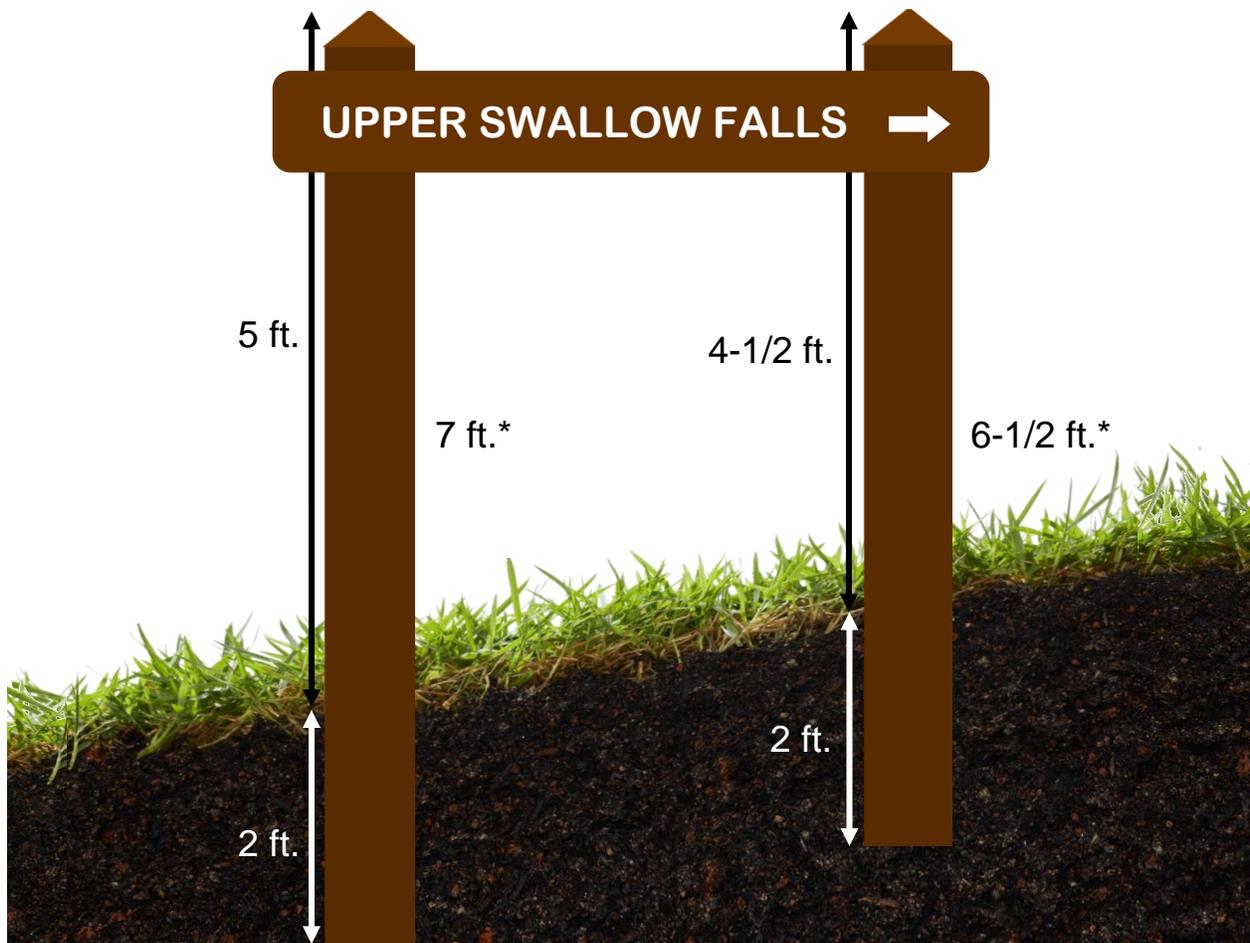
*Height will vary based on the size of the sign. (See chart on page 16).



INSTALLATION (CONTINUED)

WHEN INSTALLING A SIGN ON A SLOPE:

- Adjust the length of the sign posts as needed to achieve an appropriate height.
 - Try to keep the sign at eye level for the intended user.
 - Note that one post may need to be cut shorter than the other in some cases. (See example below).



*Height will vary based on the size of the sign. (See chart on page 16).

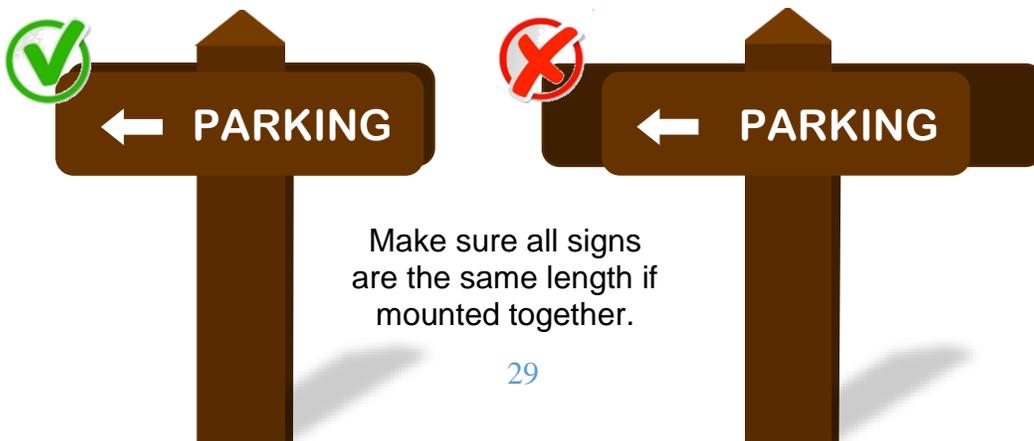
INSTALLATION (CONTINUED)

WHEN INSTALLING MORE THAN ONE SIGN ON THE SAME POST(S):

- Make sure all signs are the same length.
- Leave a 2" space between each sign. (See example below).
- Try to avoid installing more than three signs on the same post(s).
- Do not mix wood-routed signs with metal or plastic signs on the same post(s).



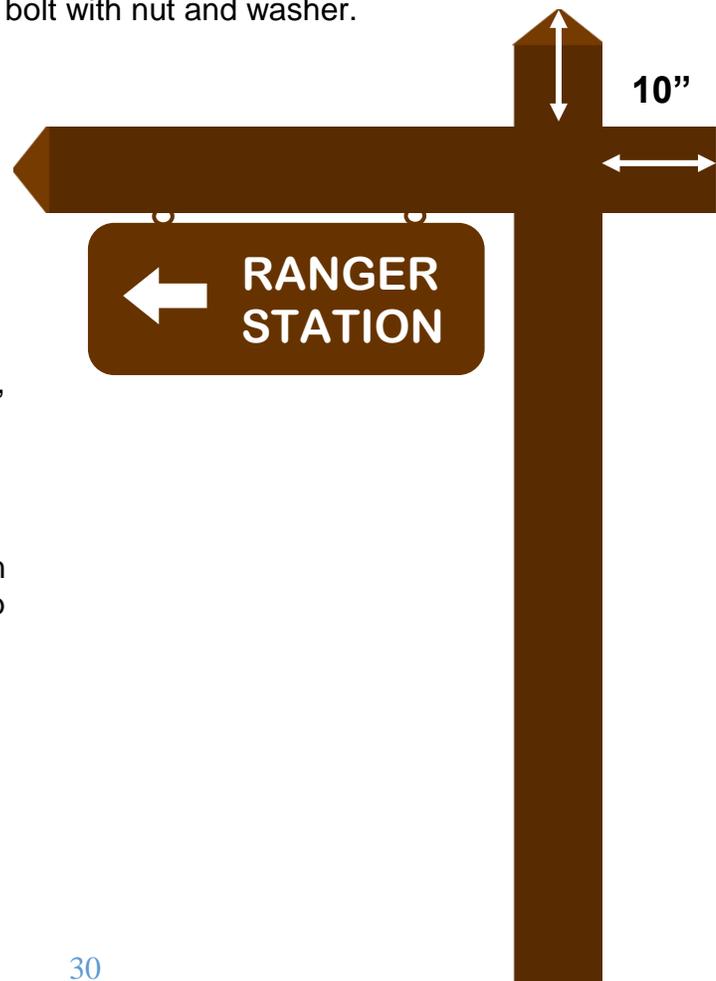
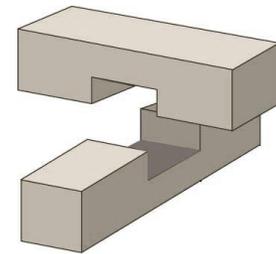
*Height will vary based on the size of the sign. (See chart on page 16).



INSTALLATION (CONTINUED)

TO INSTALL A SIGN WITH A CANTILEVER POST (OPTIONAL):

- Follow the instructions on page 15 to bevel-cut two 4"x4" sign posts.
- Cut one of the 4"x4" posts to a length equal to the length of the sign plus 18 inches. (This will be the horizontal post).
- Measure for a half-lap joint as follows:
 - Measure 10" from the unbeveled end of the horizontal post, and mark a line.
 - Measure 13-1/2" from the same unbeveled end of the horizontal post, and mark another line.
 - Measure 10" from the beveled end of the vertical post, and mark a line.
 - Measure 13-1/2" from the beveled end of the vertical post, and mark another line.
 - **NOTE:** When the two posts are crossed between the lines, they should form a 90-degree angle with 10" extending beyond the joint on both posts.
- Cut the half-lap joint as follows:
 - Adjust the blade of a table saw to a cutting depth of 1-3/4".
 - Use the table saw and chisel to cut a notch in each post between the two marks.
 - The two posts should fit snugly together at the notches, forming a 90-degree angle.
 - Secure the two posts together using wood glue and a 1/2" x 4-1/2" long carriage bolt with nut and washer.
- Install two screw-eyes into the top edge of the sign.
- Install two hooks into the bottom edge of the horizontal post, making sure the sign will be centered between the vertical post and the beveled end of the horizontal post.
- Install the cantilever post 2 feet in the ground and tamp it down, using a level to keep it straight. (Concrete mix may be used for added stability).
- Hang the sign from the hooks on the horizontal post, and then clamp the hooks closed to keep it secure.
- If needed, a chain may be installed between the two beveled ends to reinforce the cantilever arm.



APPENDIX A: LETTER KERNING (SPACING)

2-LETTER COMBOS

If the following letters appear together in a word, replace the first letter with **SPACER #1** for the first pass.

AT	AV	AY	FA	FJ	LT	LV	LY	PA	PJ	TA	TJ	VA	VJ	YA	YJ
----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----

		ROCKLER WOODWORKING AND HARDWARE													
		C	A	L	V	E	R	T		C	L	I	F	F	S
1st Pass															
2nd Pass															

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3-LETTER COMBOS

If the following letters appear together in a word, replace the middle letter with **SPACER #2** for the first pass.

ATA	ATJ	AVA	AVJ	AYA	AYJ	FAT	FAV	LTA	LTJ	LVA	LVJ	LYA
LYJ	PAT	PAV	PAY	TAT	TAV	TAY	VAT	VAV	YAT	YAV		

		ROCKLER WOODWORKING AND HARDWARE										
		A	V	A	L	O	N		A	R	E	A
1st Pass												
2nd Pass												
3rd Pass												

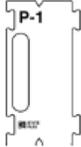
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4-LETTER COMBOS

If the following letters appear together in a word, replace the second letter with SPACER #2, and replace the third letter with SPACER #1 for the first pass.

ATAT	ATAV	AVAY	AVAT	AVAV	AVAY	AYAY	FATA	FATJ	FAVA	FAVJ
LTAT	LTAV	LTAY	LVAT	LVAV	LVAY	LYAT	LYAV	LYAY	PATA	PATJ
PAVA	PAVJ	PAYA	PAYJ	TATA	TATJ	TAVA	TAVJ	TAYA	TAYJ	VATA
VATJ	VAVA	VAVJ	YATA	YATJ	YAVA	YAVJ	YAYA	YAYJ		


ROCKLER
 WOODWORKING AND HARDWARE

	P	A	T	A	P	S	C	O
1st Pass								
2nd Pass								
3rd Pass								
4th Pass								
5th Pass								

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APPENDIX B: SAMPLE LAYOUTS

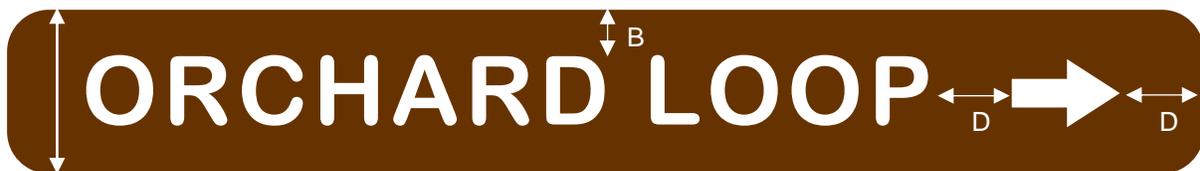
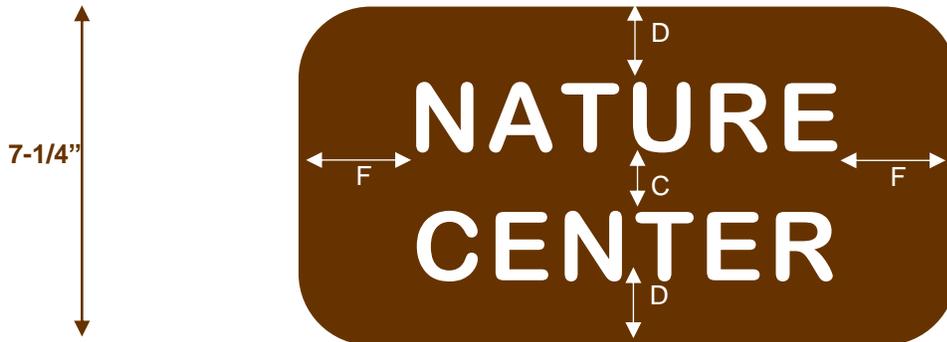
SAMPLE LAYOUTS – SMALL (1-1/2" FONT)

Top/ Bottom Margins*	Space Between Two Lines	Side Margins**	Arrow Size	Space Between Arrow & Text
1" – 1-1/2"	1" – 2"	1-1/2" – 2-1/4"	1-1/2" x 2-1/2"	1-1/2"

*Top and bottom margins should be measured from text (not from arrows).

**Side margins should be equal to the top and bottom margin x 1.5.

A = 3/4"	B = 1"	C = 1-1/4"	D = 1-1/2"	E = 2"	F = 2-1/4"	G = 2-1/2"
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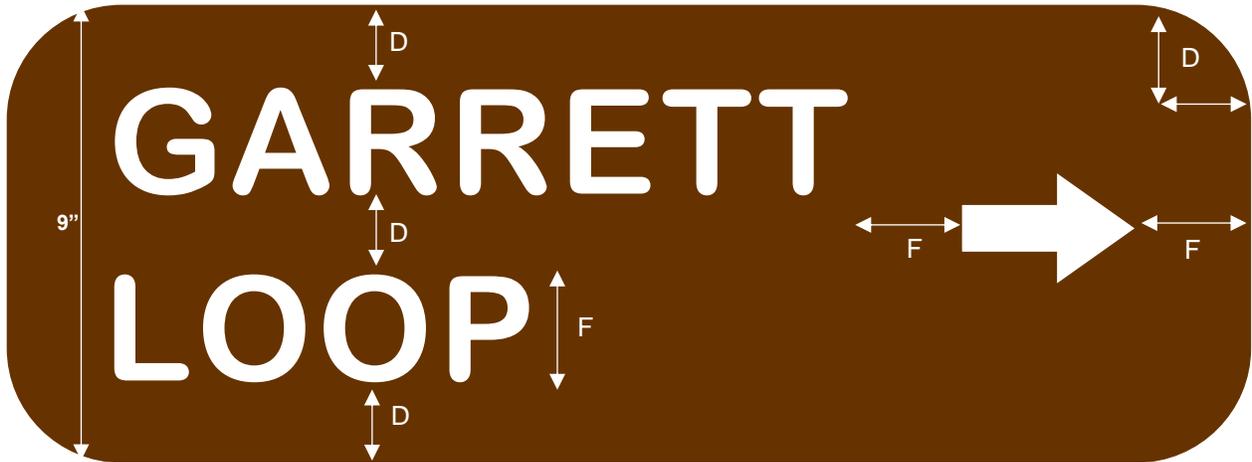


SAMPLE LAYOUTS – MEDIUM (2-1/4" FONT)

Top/ Bottom Margins	Space Between Two Lines	Side Margins	Arrow Size	Space Between Arrow & Text
1" – 1-1/2"	1" – 2-1/2"	1-1/2" – 2-1/4"*	2-1/4" x 3-3/4"	2-1/4"

*Side margins should be equal to the top and bottom margin x 1.5.

A = 3/4"	B = 1"	C = 1-1/4"	D = 1-1/2"	E = 2"	F = 2-1/4"	G = 2-1/2"
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SAMPLE LAYOUTS – LARGE (3-3/8" FONT)

Top/ Bottom Margins*	Space Between Two Lines	Side Margins**	Arrow Size	Space Between Arrow & Text
1-1/2" – 2-1/4"	1-1/2" – 2-1/4"***	2-1/4" – 3-3/8"	3-1/2" x 5-1/2"	3-3/8"

*Top and bottom margins should be measured from text (not from arrows).

**Side margins should be equal to the top and bottom margin x 1.5.

A = 3/4"	B = 1"	C = 1-1/4"	D = 1-1/2"	E = 2"	F = 2-1/4"	G = 2-1/2"	H = 3-3/8"
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SAMPLE LAYOUTS – LARGE (3-3/8" FONT)

Top/ Bottom Margins*	Space Between Two Lines	Side Margins**	Arrow Size	Space Between Arrow & Text
1-1/2" – 2-1/4"	1-1/2" – 2-1/4"***	2-1/4" – 3-3/8"	3-1/2" x 5-1/2"	3-3/8"

*The top and bottom margins should be measured from text (not from arrows).

**The side margins should be equal to the top and bottom margin x 1.5.

A = 3/4"	B = 1"	C = 1-1/4"	D = 1-1/2"	E = 2"	F = 2-1/4"	G = 2-1/2"	H = 3-3/8"
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